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ABSTRACT

New technology refers to computing and telecommunications technology--also known as information technology (IT)--which is used to create, store, handle, send, receive, and display information. Information technology has great potential for knowledge processing, and should be valuable for teaching. However, although IT's impact on curriculum in higher education has already been substantial, it is still insufficient: the demand is rising for people with information technology related educational qualifications and training. Efforts are being made to encourage the introduction of teaching about information technology into the curriculum, and the number and range of courses offered has increased significantly, as well as the opportunity for students to experience using IT. Academics and students alike are ambivalent about a high-technology academy. Although the attitudes of the academic staff will either facilitate or impede the adoption of IT, the national climate will be what moves institutions of higher education in the United Kingdom in the direction of a high-technology academy. (DJR)

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THE HIGH TECHNOLOGY ACADEMY

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The impact of the new technology on teaching in most higher education institutions has so far been peripheral. What might the high technology academy be like? Are the main benefits in lower costs or increased quality, or both? What factors might facilitate or impede its adoption?

This is the conference brochure entry: it contains a statement and three questions, each deserving our attention.

New technology's impact on teaching in higher education is peripheral

We can assume that 'new technology' refers not to biotechnology, but mainly to computing and telecommunications technology. This is now based on microelectronics and is widely known as information technology or IT. It is used to create, store, handle, send, receive and display information (Hawkridge, 1983).

Information is not synonymous with knowledge but, as the Alvey Report (1982) stressed a couple of years ago, information technology has great potential for knowledge processing. Processing of knowledge is surely one of the principal functions of higher education institutions, which have been labelled by some writers (e.g., Machlup, 1980) as important partners in the knowledge production and dissemination industry.

Lord Flowers, a very prominent British academic, suggested recently that intelligent knowledge-based systems, as now being promoted with large sums of money by the Alvey Directorate, should enable us to apply IT to 'thought processing', not merely to word processing (Hansard, House of Lords, January 18, 1984). Information technology should be rather valuable for teaching. Yet the assertion here is that its impact on teaching has so far been peripheral, that we do not yet have the Hi-Tech Academy.

There are several different ways of looking at IT's 'impact on teaching'. First, is the curriculum changing, so that there is more teaching <u>about</u> IT, its nature, applications and implications? Second, is proper provision being made to support this teaching and to enable students to <u>experience</u> IT? Third, are teaching methods changing to incorporate IT applications, or, are we using IT <u>for</u> teaching?

I would say that IT's impact on the <u>curriculum</u> in higher education has already been substantial, but insufficient. National demand is rising for people with IT-related educational qualifications and training. The number of British university graduates in this field ought to double over the next five years, yet the Institute of Manpower Studies at the University of Sussex recently warned the Government that there will soon be a serious shortage of personnel with advanced computer skills. The output of electronics and electrical engineering graduates from our universities is actually expected to <u>drop</u> next year, and the Chairman of the University Grants Committee, Sir Peter Swinnerton-Dyer, admitted in May to a House of Commons committee on

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science and technology that universities have been dragging their feet.

All the same, there is some evidence that strenuous efforts are being made to encourage introduction of teaching about IT (again, its nature, applications and implications) into the curriculum:

a) Last year the Council for National Academic Awards (CNAA) enjoined all institutions preparing students for its awards to consider the place of IT in all subjects. The CNAA stressed that its validation teams would be looking for changes in course outlines submitted to it.

b) In universities, the number and range of courses on offer, both undergraduate and postgraduate, has increased significantly, to judge from prospectuses and advertisements. Teaching (and research) in IT-related subjects is being boosted now by some 275 new posts in universities being made available (Hansard, House of Lords, April 11, 1984) by a government that has savagely cut general higher education funding. Each post carries with it money for an extra research student place.

c) If I may be forgiven for talking about my own institution, I can tell you that we know from our surveys that Open University undergraduate students want more IT-related courses, and they are getting them. I remind you that they are adults, usually in employment. Last year our postgraduate programme received a great stimulus from a multi-million pound grant from the Science and Engineering Research Council to pump-prime production of a series of IT-related courses which will lead to a taught M.Sc.

d) Jack Mansell's Further Education Unit in London did a survey early this year (Further Education Unit, 1984) and found that IT coverage in the curricula of FE institutions was very good in some but generally rather patchy. Subsequently, the Unit published a policy statement only last month (Further Education Unit, 1984a) advocating that computer literacy should be a basic skill, learnt by most students, and drawing attention to the need for all departments to appraise carefully the impact of IT upon their courses, particularly those with a strong vocational flavour.

I would also say that strenuous efforts are now being made to make proper provision for teaching about IT and to give students experience of using it.

For example, the Computer Board, which assesses universities' requirements for computing, has found it necessary to recommend urgent expansion for teaching and research. Recently, a Working Party set up by the Board reported on facilities for teaching the large numbers of students who need to gain familiarity with information technology (Computer Board for Universities and Research Councils, 1983). This report begins:

'We interpret "computer facilities for teaching" as the properly supported hardware and software tools required by students at all levels and in all disciplines to facilitate learning...this extends far beyond the present dominant use of teaching students to program and manipulate computers.'

So the Working Party clearly envisaged teaching about IT in many subjects being better supported, but went beyond that to think in terms of teaching through IT in many subjects, too.

In 1983, the universities were still a long way from the Working Party's objectives. The bald facts are that in 1983 69% of the hours of teaching use were taken up by computer science, engineering and technology students, with other science students using 17% of the hours and others accounting for only 14%. Teaching took up only 35% of terminal hours and 18% of central processor time. Of the students involved, few were given more than an hour a week on-line except in computer science. That is far from enough for students in a Hi-Tech Academy.

What might the high technology academy be like?

Academics and students alike are ambivalent about the Hi-Tech Academy, just as people generally are ambivalent about technology of all sorts. Many of you value, as I do, the personal contact involved in teaching, especially tutoring, and we fear that IT will intervene and interfere. We may even harbour thoughts that the best teachers do not need to use any technology.

Twenty years ago, Marris (1964) asked whether personal teaching in higher education was either relevant or efficient. He imagined an 'entirely automatic university':

> 'The student clocks in each morning, and — his presence registered on the record sheets -- sets about the tasks he has booked for the day. He carries with him a comprehensive printed guide for his course, which he received when he first enrolled: it includes an introduction to each part of the syllabus explaining why it is included; a detailed list of the subject-matter to be mastered; references; a guide to the rooms where the appropriate apparatus is installed; and instructions about the use of revision notes, example sheets, and test questions, with which he has also been provided.'

(So far, it sounds something like the Open University, doesn't it?)

> 'He checks off his progress in a space beside each item of the guide, and makes his way to a teaching machine, where he inserts the next section of programmed film. His subject is unfolded to him, logically, step by step, and with each frame is a question which he must answer correctly, before the programme takes him forward to the next point. He is continually rewarded with a sense of achievement, as he masters each step. If he is a linguist, he may spend some hours with a tape recorder: a scientist has experiments set up for him in the laboratory. To enliven this austere regime, there are lectures broadcast on closed-circuit television, in which distinguished academics discuss their research or talk at large about their subject. Towards the end of the day, everyone relaxes over films of wider cultuural interest — on the arts, developments in technology, social and political issues. So each student edges his way towards his final examinations, whose scope and standard he can fairly predict. In all his university years he need meet only the electrician who mends the fuse in his teaching machine, the library clerk who hands him his reference or

reel of microfilm, the waitress who passes him his hamburger and chips and the janitor who, punctually at 10 p.m., locks him out till the morning. He is eventually rewarded by a ... card on which his academic record has been punched, holed in the final column with the result of his examination.'

Marris suggests that the automatic university deserves to be taken seriously because it could perform far more efficiently many of the functions of universities. I doubt whether he is right, but efficiency and cost-effectiveness are strong arguments in our present state.

Twenty years on, as we look towards the end of the century, what is it reasonable to expect in the Hi-Tech Academy? That depends on whether you are an optimist or a pessimist.

Optimists believe IT is so important that it will pervade the curriculum and become generally essential for good teaching, and that resources will be made available for it on a grand scale. Some even say that because of IT more jobs will have to be created in higher education. As justification, they point to examples such as the new fibre-optics cable television link between five London teaching hospitals, an experimental link financed with £1 million from the Department of Trade and Industry (Turney, 1984).

Pessimists believe IT is so inherently damaging to higher education that it should be prevented from entering the curriculum, and that it militates against good teaching. They resist 'the imperialism of instrumental reason', to quote Joseph Weizenbaum (1984), Professor of Computer Science at the Massachusetts Institute of Technology. They say that resources will be provided for it at the expense of other disciplines, and believe it will lead to job losses in higher education.

Optimists note what is happening outside higher education and say we cannot remain aloof. According to a recent report for the Education and Human Development Committee of the Economic and Social Research Council (Wood, 1984), over 2 million home computers had been sold in Britain by the beginning of this year and the figure was expected to climb to 5 million by next January. Admittedly, many of these computers are small and quite unsuited to use in higher education, but it seems reasonable to expect that many owners will trade up to more powerful machines within a few years. The young, in particular, will want more computing power, and expect to use it in their own post-secondary education.

Pessimists note that electronic universities are not likely to be based on present institutions, where face-to-face teaching dominates and attitudes are negative towards technology-mediated learning. They point to the fact that, under financial pressure, British universities are actually cutting back on use of IT, as for instance at Aberdeen, where an award-winning television service is being closed down (Wojtas, 1984). They may perhaps concede that the Open University is the place to use IT. They may even say that some of their own limited extra-mural work might be extended through using IT. They do not think that a new and separate electronic university is possible in the political and economic climate likely to prevail over the next decade or more.

Optimists see IT as opening up access to higher education to a much wider population, through use of cable, satellite broadcasting, video,

microcomputers and so on, which will bring education to people at home or at work. Pessimists say that only the rich will have such access, and the rich prefer face-to-face education anyway. The market will not be large enough to achieve the necessary economies of scale, they say, and commercial interests will therefore not be attracted.

Optimists see IT as offering opportunities to bring high quality courses, taught by the best teachers, to all parts of the country. Pessimists say that the best teachers will have nothing to do with it. Optimists claim that any subject can be taught with the help of IT. Pessimists assert that many disciplines, particularly in science and the arts, simply cannot be taught through such media.

Optimists expect plenty of institutional collaboration and interchange in using IT for teaching, but pessimists fear the dangers of standardisation and conformity in the name of cost-effectiveness.

By the time our next meeting in Lancaster comes round, in 1988, not much is likely to have changed to bring in the Hi-Tech Academy. I predict there will be more IT, more computers, more networks, in British higher education, but that the amount of time the average student spends on IT will not have increased significantly. Since at least 80% of present academic staff are likely to be still in post, four years from now, I can also predict safely that most of these will still know very little about IT for teaching and research, and that many will continue to resist its invasion of their curricula.

The picture in 2000 AD is more difficult to predict, of course. We do not know what technological advances are likely to occur by then, assuming that we have not blasted ourselves into oblivion. Nor do we know what resources will be available for using this new technology in higher education. We do not know how much government control will be exercised over curriculum and methods by that date, although in the United Kingdom this control at present is increasing.

We do know that our students in that year are already born, and that some, but not all by any means, will experience much IT first-hand at home and in primary or secondary school. Of the present staff, somewhat less than half will still be teaching then. Those of us retiring or otherwise leaving will be replaced by staff who, in general, are more acquainted than we are with IT (its nature, applications and implications) and with using it for teaching and learning. We can be fairly sure that the buildings used for higher education in 2000 AD will be much the same as the ones we have now, -- not very suitable for teaching with IT.

Is it likely that by 2000 AD students will turn to their own computers, plus educational software (courseware) which they have selected and purchased for themselves, as a better means of learning than attending lectures on some distant campus?

Will state-financed higher education, largely on a face-to-face basis in old buildings and with inadequate equipment, be challenged and partly replaced by private, profit-making electronic educational enterprises? Some of these enterprises could be linked directly to specific economic sectors, such as the electronics industry itself or banking and life insurance.

Lord Flowers, to quote him once more, thinks that the trouble with IT in this country at present is that it is more a case of technology push rather than application pull. Here is the technology looking for a problem, rather than people looking for technology to solve a problem. Will the Hi-Tech Academy of 2000 AD be technology-led, academic-led, demand-led, profit-led, or social needs-led? These are interesting questions.

Benefits: lower costs or increased quality, or both?

What might be the benefits offered by a Hi-Tech Academy? It is difficult to be certain about lower costs, regardless of whether the enterprise were state- or privately-owned. The evidence to date (Eicher and others, 1983) is that IT used for teaching usually adds to costs, although it may well make possible something that could not otherwise be achieved. Lower costs depend heavily on economies of scale, which come about through standardisation, and standardisation is anathema to most institutions of higher education.

Yet British universities and polytechnics, almost certainly with reduced resources, must find ways of coping with the continuing demand for higher education. July figures from the Department of Education and Science (DES, 1984) reflect greater and more sustained demand than the controversial projections published by the Department last year. Some opportunities for expansion, as envisaged for example by the Assocation of University Teachers (AUT, 1984), may only be taken up through increased use of IT.

At a commonsense level, it is clear that institutions using IT to teach about IT will offer better quality than those who do not use it. If we are talking about using IT for teaching other subjects, however, claims of increased quality being attributable to IT cannot yet be supported by a mass of sound evidence.

There have been exciting and valuable experiments in using IT for teaching in higher education, and most of these have been well documented. Whereas a few years ago IT was being used mainly for rather boring exercises (drill-and-practice), now we have some very sophisticated teaching through simulations and modelling, and through computerised problem-solving tutorials (Computer Board for Universities and Research Councils, 1983). Student access to computerised research data-bases is now commonplace. Experiments with microcomputer-controlled videotape and videodisc, remote electronic blackboards, telephone tutorials and conferencing, and even videotex and teletext (telephone- and television-borne text messages), have all shown educational promise. A few of their exponents are here this week and can speak for themselves about the ways in which their work increases understanding. Some of the most advanced work on intelligent knowledge-based systems, such as at the Massachusetts Institute of Technology, has remarkable potential if funds can be found to exploit it fully (Hawkridge, 1983). Many other projects were reported recently to a conference of the Organisation for Economic Co-operation and Development (1984) and in an Open University report to the Commission of European Communties (Zorkoczy, 1984).

But there is still room for doubt about the cost-effectiveness of IT for teaching, and those who doubt most have only to point to the huge number of hours normally required to prepare high quality educational

software. At the Open University we certainly know about that.

Factors that may facilitate or impede adoption

I begin with us, the academic staff. We may facilitate the advent of the Hi-Tech Academy, or we may impede it. How could we impede it? I mentioned earlier our attitudes. Some of us do not want anything to do with IT and say so. Peace be with all of us.

Those of us who know something about IT could strike camp and move off to better jobs in industry, perhaps overseas, leaving behind the non-IT staff. With private sector pay rising so much faster than ours, nobody could blame us for leaving the sinking ship, could they? Our departure would make it more difficult for higher education institutions to move towards adopting IT, teaching about it, or teaching through it.

Others of us want to be retrained in using and teaching through IT. Without proper retraining programmes, which are not widely available at present to academic staff in higher education, adoption will clearly be impeded. In this country, as yet, there is no national programme for us, to parallel that for the school teachers.

The Computer Board says that, besides us, staff are needed to a) maintain existing software, b) develop, install and test new software, and c) provide programming advisory services to large numbers of students (Computer Board for Universities and Research Councils, 1983). Without properly trained staff, the Hi-Tech Academy cannot happen. You may perceive a paradox here: humans are still of prime importance, even before machines.

Other resources will be needed, too, of course. Earlier, I mentioned software and hardware. Let me be more specific. Resources are needed for hardware (all that you can touch, as somebody said). The Computer Board has already recognised the swing away from large computers towards microcomputers linked as needed to large machines. Sums available to universities for purchasing microcomputers amounted to about £1.6 million over the years 1979-81 (Computer Board for Universities and Research Councils, 1984), but that is not nearly enough. Universities have been obliged to make further purchases from their own funds, and, although the costs of IT hardware are likely to drop for specific items, the Hi-Tech Academy cannot come about without further very large investments in hardware.

A recent inspection of engineering departments in polytechnics (Her Majesty's Inspectorate, 1984) noted their obsolete or inadequate equipment. Yet in polytechnics about £4 million is being spent each year on computing, mostly for teaching, for a total student body of about 150,000. This compares with about £1 million only, spent by the Computer Board each year for university teaching facilities, for about 50% more students (Computer Board for Universities and Research Councils, 1983). So polytechnics should be better off, at present, in terms of hardware.

Then the programs that command the hardware have to be purchased or written. These are not cheap at present and prices are rising. The Computer Board's Working Party last year saw this as the major stumbling block to a more universal adoption of computers in education, and predicted that the shortage of educational software programmers would

continue. There is hope that the cost of programming will drop eventually, when means are found to automate some aspects of it with the help of artificial intelligence, but the cost curve is still going up.

David Bald, managing director of Hewlett Packard in this country, thinks IT-related training here is 'hopelessly fragmented' (Financial Times, February 21), and in general he is right. As a matter of fact, the same statement would be true of the United States or any European country. The Department of Trade and Industry has now set up an Information Technology Skill Shortages Committee to examine demand and supply in this field.

The biggest task, for higher education, is to prepare the courses. Educational software is sometimes called 'courseware', and almost without exception, high quality courseware is expensive. In theory, there should be considerable economies of scale obtained through the same high quality courseware being used for large numbers of students. This would require coordination and cooperation never before seen in British higher education.

Conclusion

The national climate for IT will be what moves our universities, polytechnics and institutions in the direction of the Hi-Tech Academy, gradually and not universally. I believe we shall have neither hi-tech ivory towers nor hi-tech student factories.

The Report of the Computer Board's well-qualified Working Party, describes the IT facilities an 'advanced university' (as opposed to a 'backwater' university) might have in 1992, only eight years away:

> 'All students have a portable personal computer...that can be connected to the local area network. All study bedrooms and library desks have connectors... Fast high quality printers are...in most university buildings. New tutorial and simulation software is produced by small teams including lecturers, computer centre programmers/analysts and educational technologists. These teams sometimes include academics at other universities who collaborate via inter-university network(s)... The development cost of new educational software is partly offset by the sale of software licences. ...part-time students make extensive use of the communications facilities to interact with other students and lecturers. Students studying vocational subjects...use the communications network to ... carry out project work with contemporary applications...'

> 'All students would use their computers regularly to send and receive electronic mail, to house the library catalogue for source books (for) their current studies, to write essays using word-processing software and to answer tests set on their courses. ...they would use specific learning packages -- not only in numerate subjects...but also in arts subjects ...(including) literature...music and the appreciation of graphic art.'

Whether it happens in 1992 or 2000 AD, would you feel happy working in that kind of Hi-Tech Academy? Even more to the point, would you enjoy being one of its students? I think I would, given that a good teacher or two would be around.

References

Alvey Committee (1982). A Programme for Advanced Information Technology. London: HMSO.

AUT (1984). The Future of the Universities. London: The Association.

Computer Board for Universities and Research Councils (1983). Report of a Working Party on Computer Facilities for Teaching in Universities. London: The Board.

Computer Board for Universities and Research Councils (1984). Report of the Board for the Period 1st April, 1979-31st March, 1983. London: HMSO.

DES (1984). Demand for Higher Education in Great Britain 1984-2000. DES Report on Education No. 100. London: The Department.

Eicher, J.C., Hawkridge, D.G., McAnany, E., Mariet, F. and Orivel, F. (1983). The economics of new educational media. Vol. 3. Paris: Unesco.

Further Education Unit (1984). Informationm Technology in FE: An Occasional Paper. London: The Unit.

Further Education Unit (1984a). Information Technology in Further Education: A Framework for Action in IT. London: The Unit.

Hawkridge, David (1983). New Information Technology in Education. London and Baltimore: Croom Helm and Johns Hopkins University Press.

Her Majesty's Inspectorate (1984). Engineering in Polytechnics: A Report on HMI Visits to 13 Polytechnic Engineering Departments. London: Department of Education and Science.

Machlup, F. (1980). Knowledge and Knowledge Production. Princeton, New Jersey: Princeton University Press.

Marris, P. (1964). The Experience of Higher Education. London: Routledge and Kegan Paul.

Organisation for Economic Co-operation and Development (1984). Research and Development Relating to the Educational Applications of New Information Technologies. Paris: OECD.

Turney, John (1984). Government funds video teaching link. Times Higher Education Supplement, January 27.

Weizenbaum, Joseph (1984). Computer Power and Human Reason: From Judgement to Calculation. London: Penguin.

Wojtas, Olga (1984). Aberdeen to lose its television service. Times Higher Education Supplement, March 2.

Wood, J.D. (1984). The Resources and Potential of Current U.K. Commercial Organisations Supplying Educational Software for the Microcomputer. London: Economic and Social Research Council.

Zorkoczy, Peter and others (1984). Opportunities for Information Technology-based Advanced Educational Technologies. Milton Keynes: Open University.